CLAIMS

1. A micro thermoelectric gas sensor comprising:

a membrane for heat shielding formed on a substrate,

a catalyst material that induces a catalytic reaction in contact with a gas to be detected, a thermoelectric conversion material film that converts a local temperature difference produced by heat generation caused by the reaction into a voltage signal, and a microheater for temperature control for facilitating stable gas detection of the gas sensor formed, which are on the membrane, and

a high-temperature section and a low-temperature section of a thermoelectric thin film formed on the same membrane.

2. The thermoelectric gas sensor according to claim 1, wherein the thermoelectric conversion material film is a segment of a thermocouple having a high-temperature section and a low-temperature section.

3. The thermoelectric gas sensor according to claim 1, wherein the thermoelectric conversion material film is a thermocouple having a high-temperature section and a low-temperature section, a plurality of the

thermocouples are provided, and the plurality of thermocouples are connected in serial.

4. The thermoelectric gas sensor according to any one of claims 1 through 3, wherein a membrane with a thickness of 1 μm or less is obtained by wet etching a rear surface of the substrate.

5. The thermoelectric gas sensor according to claim 4, wherein a plurality of membranes are provided on the substrate.

6. The thermoelectric gas sensor according to any one of claims 1 through 5, wherein an insulating film is formed in a state of contact with the membrane on the membrane, a bonding film is formed on the insulating film in a state of contact with the insulating film and a heater for serving to bond the insulating film and the heater, and a catalytic material layer is formed in thermal contact with said heater being electrically insulated by the insulating film.

7. The thermoelectric gas sensor according to claim 1, wherein after a thermoelectric conversion material film pattern has been produced, the pattern is

heat treated at a high temperature to improve crystallinity thereof.

8. The thermoelectric gas sensor according to any one of claims 1 through 7, wherein a SiGe thin film is formed as the thermoelectric conversion material film.

9. A method for producing a micro thermoelectric gas sensor, comprising the steps of:
forming a membrane for heat shielding on a substrate, forming a thermoelectric conversion material film pattern on the membrane, forming a heater pattern thereafter, forming an insulation layer of an oxide film; opening a window for an electrode contact section and then forming a wiring pattern, and wet etching the rear surface of the substrate.

10. A method for forming a micropattern of a catalyst or a resistor on a substrate of a gas sensor or a thermoelectric power generator, comprising the steps of:
(1) designing and preparing a functional material serving as a starting material for a catalyst or a resistor by controlling the predetermined microstructure thereof, (2) applying the functional material serving as a starting material for a catalyst or a resistor to a predetermined

position on a substrate according to a predetermined pattern by discharging, while moving a dispenser three-dimensionally, and (3) thereby forming a micropattern in a state where the predetermined microstructure of the functional material remains controlled.

11. The method for forming a micropattern according to claim 10, wherein a viscosity of the starting material is within a range of from 0.001 to 100 Pa·s.

12. The method for forming a micropattern according to claim 10, wherein the micropattern is formed on the substrate by discharging the material under controlled impacts and without mutual contact in a relative arrangement of the substrate and a nozzle tip of a discharge section of the dispenser.

13. The method for forming a micropattern according to claim 10, wherein the functional material is applied to a specific portion of a groove bottom of the substrate that has irregularities in the substrate surface shape by adjusting the relative arrangement of the substrate and a nozzle tip of a discharge section of the dispenser.

14. A gas sensor element, having a catalyst material formed by (1) designing and preparing a

functional material serving as a starting material for a catalyst or a resistor by controlling the predetermined microstructure thereof, (2) applying the functional material serving as a starting material for a catalyst or a resistor to a predetermined position on a substrate according to a predetermined pattern by discharging, while moving a dispenser three-dimensionally, and (3) thereby forming a micropattern in a state where the predetermined microstructure of the functional material remains controlled.

15. A thermoelectric power generator, having a heat generating section formed by (1) designing and preparing a functional material serving as a starting material for a catalyst or a resistor by controlling the predetermined microstructure thereof, (2) applying the functional material serving as a starting material for the catalyst or resistor to a predetermined position on a substrate according to a predetermined pattern by discharging, while moving a dispenser three-dimensionally, and (3) thereby forming a micropattern in a state where the predetermined microstructure of the functional material remains controlled.

16. The gas sensor element according to claim 14, wherein a temperature at which a catalytic reaction

proceeds actively is reduced to room temperature or below and heating for activating the catalytic reaction is made unnecessary by forming a micropattern in a state where a predetermined microstructure including the shape and distribution state of particles that are the main components of the functional material including an oxide and a catalyst remains controlled.

17. The thermoelectric power generator according to claim 15, wherein a temperature at which a catalytic reaction proceeds actively is reduced to room temperature or below and heating for activating the catalytic reaction is made unnecessary by forming a micropattern in a state where a predetermined microstructure including the shape and distribution state of particles that are the main components of the functional material including an oxide and a catalyst remains controlled.

18. The method for forming a micropattern according to claim 10, wherein when preparing a catalyst powder or catalyst paste for use in said micropattern, a metal chloride and an oxide powder is mixed with an organic dispersion material and heat treatment is conducted at a temperature from 150°C to 300°C, or a pattern of a composite of nanometer metal ultrafine particles is

formed by mixing an oxide powder and a metal with a nanometer particle size.

19. The gas sensor element according to claim 14, wherein the heat generation of a catalyst can be raised to a maximum level by employing, in a thermal insulating structure such as a membrane, the catalyst pattern formation that enables the application in a state in which said microstructure remains controlled.

20. The thermoelectric power generator according to claim 15, wherein the heat generation of a catalyst can be raised to a maximum level by employing, in a thermal insulating structure such as a membrane, the catalyst pattern formation that enables the application in a state in which said microstructure remains controlled.

21. The gas sensor element according to claim 16, wherein a combustion gas with a detectable gas concentration range from 1 ppm and below to 5% or more can be detected by using a thermoelectric conversion principle in said gas sensor element.

22. The method for forming a micropattern according to claim 10, wherein properties of a resistor material are used to increase a gas response rate in low-

temperature operation by integrally employing, in a microelement structure such as a membrane, the resistor pattern formation that enables the application in a state in which crystallinity and microstructure remain controlled.

23. A gas sensor element, characterized in that a micropattern of a catalyst material or a resistor is formed in a predetermined position on a substrate in a state where a predetermined microstructure thereof remains being controlled.

24. A thermoelectric power generator, characterized in that a micropattern of a catalyst material or a resistor is formed in a predetermined position on a substrate in a state where a predetermined microstructure thereof remains being controlled.